Fossil pond plants bear tattoo of K-T crash

The ancient remains of a humble lily pond in eastern Wyoming provide a blow-by-blow record of the cataclysm that wiped out a large fraction of existing species 65 million years ago, according to an expert on fossil plants.

Botanical evidence from the pond suggests a meteorite walloped Earth around early June, sending the northern hemisphere into an out-of-season freeze, says Jack A. Wolfe of the U.S. Geological Survey (USGS) in Denver. The climate quickly warmed, and then, within months, a second, smaller meteorite struck, he reports in the Aug. 1 NATURE.

Such a detailed description of the long-ago event has sparked criticism from researchers who believe the story may contain more fantasy than fact.

Wolfe constructed his scenario after studying the plant fossils within a layered sequence of rocks at Teapot Dome, a site dating to the Cretaceous-Tertiary (K-T) boundary — the time some 65 million years ago when the last remaining dinosaurs and a number of other animal and plant species died off. Many researchers blame the mass extinction on climate disruptions caused by one or more meteorite impacts.

At Teapot Dome, Wolfe found water-lily and lotus leaves bearing distinctive irregular folds that he believes document the chilly aftermath of the impact. He suggests the crash lofted enough light-blocking debris into the atmosphere to freeze the pond, causing ice to develop inside the lily and lotus leaves. Because water expands as it freezes, ice inside the leaves would have buckled their outer cuticle. To test that hypothesis, he produced the same pattern of folds by freezing modern lily and lotus leaves.

Researchers have discussed possible climatic implications of a huge meteorite strike at the K-T boundary for a decade. But until now, none had found proof of a post-impact cooling, says Wolfe. "This is the first physical evidence of actual freezing from an impact winter," he says.

Wolfe thinks the pond fossils contain enough information to pinpoint the approximate month of the impact. The Teapot Dome rocks contain seeds from the water lilies, but none from the lotuses, indicating that only the lilies had bloomed and produced fruit by the time they froze. Botanical evidence from eastern Wyoming suggests that around the time of the K-T boundary, lotuses bloomed in late June, Wolfe says, indicating the impact occurred earlier, near the beginning of June.

In previous work, Wolfe determined that a moist, superwarm period followed the impact winter. Teapot Dome rocks support that idea because fern spores lie atop the debris layer from the first impact. A debris layer higher up suggests a second, smaller impact occurred after that warm period started, only months after the first strike, he says.

Recent reports have focused attention on the Caribbean as the possible site of a K-T crash (SN: 11/17/90, p.319), and Wolfe proposes this could have produced the lower impact layer at Teapot Dome. The second layer could have come from a strike much closer to the pond. One candidate is the Manson, Iowa, crater — a structure researchers have dated to the time of the K-T boundary.

Like almost all research on the K-T boundary, Wolfe's work has excited considerable controversy. Many scientists, including some at his own office, think he has speculated too much.

"I think he's extrapolated an awful lot," says pollen expert Douglas J. Nichols, also with the USGS in Denver. "I predict that the scientific community will not accept this story; some people may even laugh at it." Geologist Bruce F. Bohor from the USGS says Wolfe's story does not fit with other K-T boundary evidence from around the world.

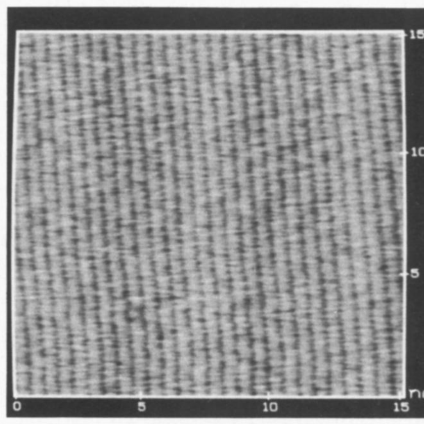
Wolfe contends, however, that most geologists and paleobiologists think about events on a geologic time scale and are not accustomed to considering what happens on a scale of months or weeks.

James A. Doyle, a paleobotanist at the University of California, Davis, agrees about that. While not totally convinced by the scenario, he says that "[Wolfe's] observations and story form a nice consistent whole. I don't see any major flaws in his hypothesis." — *R. Monastersky*

Teflon grid brings order to thin films

The nonstick surface that made pots and pans so much easier to wash now promises to ease the jobs of chemists who seek to create well-ordered materials.

Two materials scientists have discovered they can make single crystals line up by depositing them on a very thin film of poly(tetrafluoroethylene). Better known as Teflon, the film helps orient molecules by acting as a microscopic grid, report Jean Claude Wittmann of the Charles Sadron Institute in Strasbourg, France, and Paul Smith of the University of California, Santa Barbara (UCSB).



Hansma/UCSB

This image, taken with an atomic force microscope, shows Teflon molecules lined up in parallel rows.

Well-aligned crystals make materials stronger and stiffer — 100 times more so in the case of some crystalline polymers, say Smith and Wittman. Compounds also tend to conduct electricity and transmit light better when their molecules line up, notes Richard Friend of the Cavendish Laboratory in Cambridge, England.

Chemists often make polymers more ordered by spinning and stretching them under tension. But depositing them on Teflon results in a much greater degree of alignment, Smith says.

"The technique provides a particularly versatile method that will allow fabrication of ordered molecular films drawn from a wider range of materials," writes Friend in an editorial accompanying the research report in the Aug. 1 NATURE. He sees the process as a boon to researchers creating molecular-sized devices for electronics.

Wittmann and Smith were studying properties of well-ordered materials when they first noticed that rubbing a piece of white Teflon on glass under the right temperature and pressure conditions, and at the right speed, left behind a very thin layer of Teflon molecules. In recent work by Helen Hansma at UCSB, atomic force microscopy revealed that these long chains lie flat on the glass, forming parallel ridges along the direction of rubbing, Smith says. Scientists studying friction had observed this tendency years earlier, he notes, but he and Wittmann were the first to realize they could use the ordered array as a template for making other films.

They can now control the temperature, pressure and deposition rate of vapors or melted material well enough to make ultrathin, nearly transparent films. Smith says he has used the thin-film grid to order many materials, including nylon, liquid crystals and polyaniline, a promising conducting polymer. Theoretically, the technique could also yield very large-area films, he adds.

But don't expect to fry up an exotic thin film in your kitchen. Teflon pans have blended, baked-on coatings whose molecules actually lack order, Smith explains. — *E. Pennisi*